Vol. X OCTOBER, 1899 No. 10

The National Geographic Magazine

AN ILLUSTRATED MONTHLY

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CONTENTS

		PAGE
LIFE ON A YUKON TRAIL. With map and illustrations.	ARTHUR P. DENNIS.	377
TIDES OF CHESAPEAKE BAY.	E. D. PRESTON.	391
THE RELATION OF FORESTS AND FOREST FIRES. With illustrations.	GIFFORD PINCHOT.	393
VARIATIONS IN LAKE LEVELS AND ATMOSPHERIC PRECIPITATION.	A. J. HENRY.	403
CALCULATIONS OF POPULATION IN JUNE, 1900.	HENRY FARQUHAR.	406
PEARY'S WORK AND PROSPECTS.	H. L. BRIDGMAN.	414
PEARY'S EXPLORATIONS IN 1898-1899.		415

The Definite Location of Bouvet Island, p. 413; The California and Nevada Boundary, p. 416; Geographic Literature; Beresford's, "The Break-up of China," etc., p 418; Geographic Miscellanea, p. 421.

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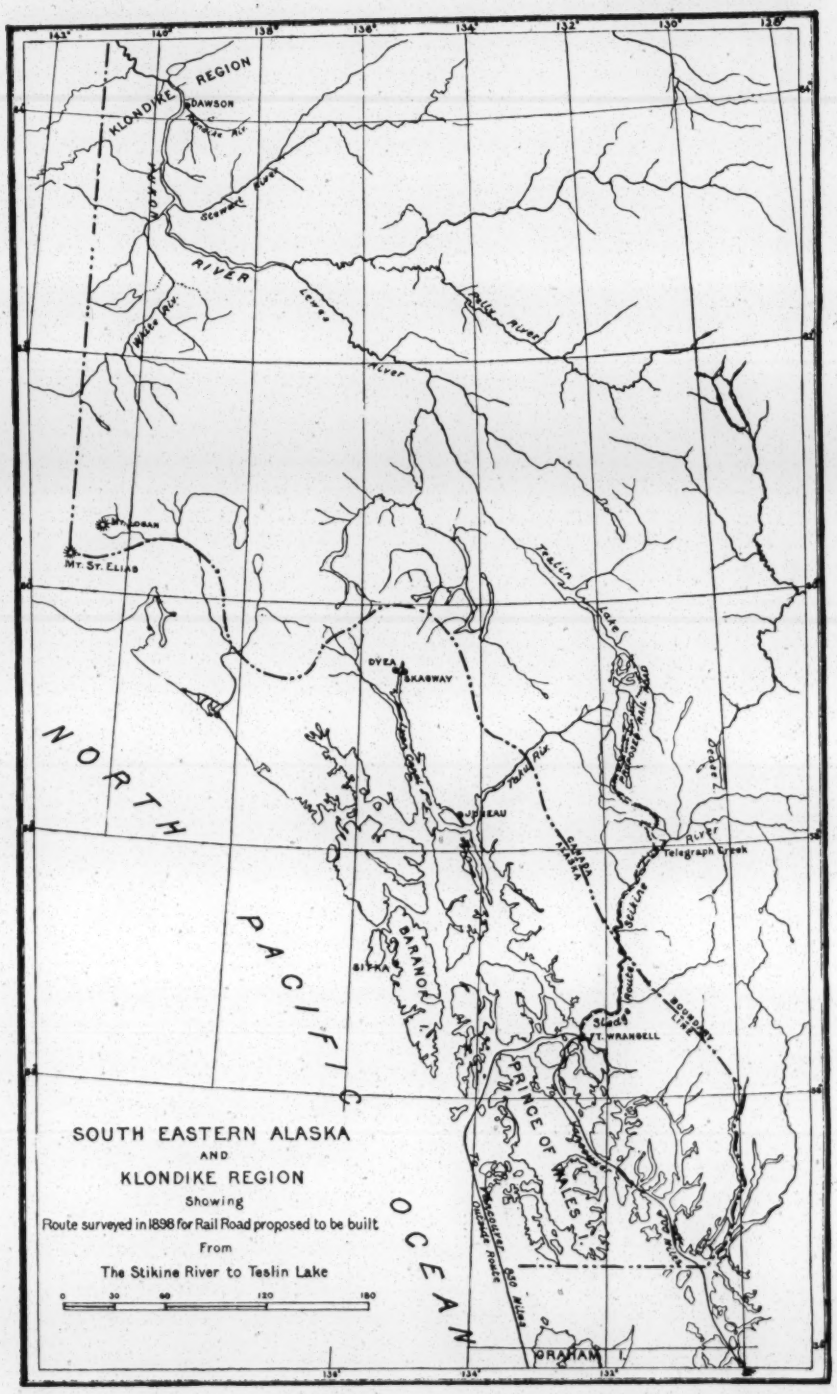

KLONDIKE REGION
DAWSON
Stewart River
RIVER
White Riv.
Lewes
River
Pelly River
MT. LOGAN
MT. ST. ELIAS
Teslin Lake
DYEA
SKAGWAY
Taku Riv.
JUNEAU
CANADA
ALASKA
Telegraph Creek
Stikine River
Dease L.
NORTH PACIFIC OCEAN
BARANOF I.
SITKA
Sledge Route
BOUNDARY LINE
FT. WRANGELL
PRINCE OF WALES I.
Outside Route
GRAHAM I.
SOUTH EASTERN ALASKA
AND
KLONDIKE REGION
Showing
Route surveyed in 1898 for Rail Road proposed to be built
From
The Stikine River to Teslin Lake
0 30 60 120 180

THE
National Geographic Magazine

VOL. X OCTOBER, 1899 No. 10

LIFE ON A YUKON TRAIL

By ALFRED PEARCE DENNIS, Ph. D.

The Stikine river is the chief feature of the hydrography of northern British Columbia. The waters of this stream mingle with the Pacific near Fort Wrangell, Alaska. About 2,000 miles further around the big Alaskan peninsula the waters of the majestic Yukon pour into Bering sea. These rivers, 2,000 miles apart at their mouths, are less than 200 miles apart at the nearest point of their headwaters.

As the Stikine is open to free navigation by treaty with the United States, it was proposed by the Canadian authorities when the Klondike excitement was at its height to build a narrow-gauge railway from Glenora, the head of navigation on the Stikine, to Teslin lake, one of the principal sources and feeders of the Yukon. It was claimed that with the completion of the railway a passenger could go through from Vancouver to Dawson in fifteen days, with no greater inconvenience than the labor involved in stepping from the river steamer to the train. It was hopefully predicted that with the opening of the route the bulk of Klondike travel would be diverted from the American ports of Dyea, Skagway, and St Michael, and the volume of outfitting trade transferred from Seattle to Vancouver and Victoria. After four months of preliminary survey work for the proposed railway the project was in June, 1898, abandoned. A number of causes contributed to the collapse of the enterprise: First, the waning of the Klondike excitement; second, the failure of the Dominion senate to ratify a heavy subsidy granted the road by the Canadian assembly; and, third, the energy in execution dis-

played by American capitalists in pushing the enterprise of a road to Lake Bennett *via* the White pass. Scarcely too much could be said for the All-Canadian route as a potentiality, but as an actuality, in the undeveloped graces of early infancy, it justly earned the reputation of being the most arduous and difficult of all the so-called practicable trails to the Yukon goldfields.

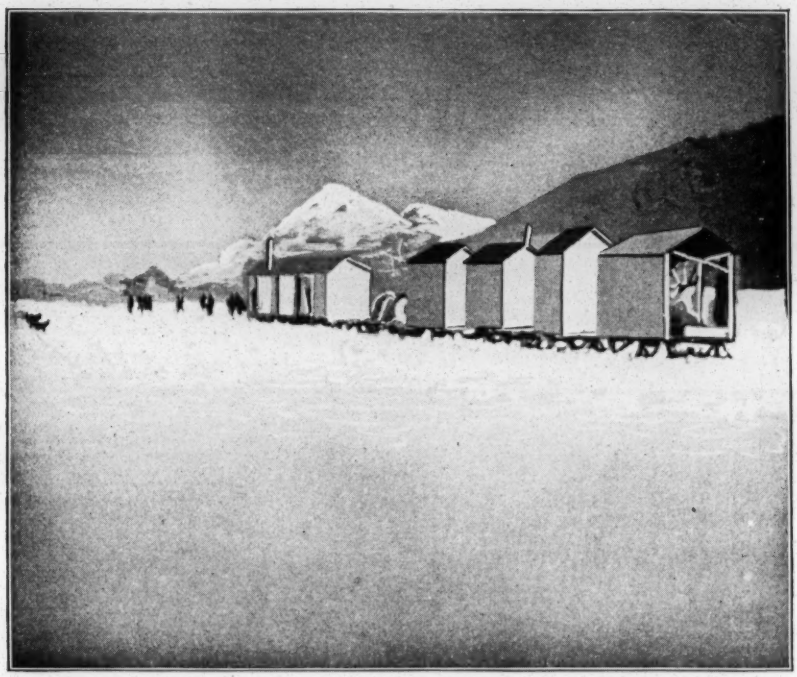
Compelled by ill-health to suspend for two years all work requiring mental stress, the writer became tolerably familiar in the mountains of southern British Columbia with the actual requirements of various rough manual employments and the actual characters of various rough folk of the mines and logging camps. It was a desire to add to these experiences with rough jobs and rough people that led him to apply for a subordinate position on the exploration and survey party dispatched in the winter of 1898 to the northern wilderness in the interests of the All-Canadian route to the Yukon.

Our party of 13 men took steerage passage in February from Vancouver, B. C., to Fort Wrangell, Alaska, in a battered old Chinese freighter, the *Amur*. From this point we crossed on open water to Cottonwood island, at the mouth of the Stikine river. It was the purpose of the party to move up the river for 150 miles over the ice to Telegraph creek. From this point we were to strike northward into the interior, for the purpose of running preliminary surveys 140 miles to Teslin lake, one of the principal sources and the head of navigation of the Yukon.

Camped on the ice and dirty snow at the mouth of the Stikine was a motley crowd of not less than 1,000 men who had been diverted from the accustomed routes to the Klondike by false reports about the opening of this new route. They had been informed that a serviceable trail connected Telegraph creek with Teslin lake. Many, too, had visions of town sites along the proposed railway, and hoped to "get in on the ground floor." They were sadly misled. The information was false, and the major portion of the wayfarers, after months of struggle, were utterly baffled in the attempt to thread their way through a remorseless wilderness of mountain and swamp to Teslin lake.

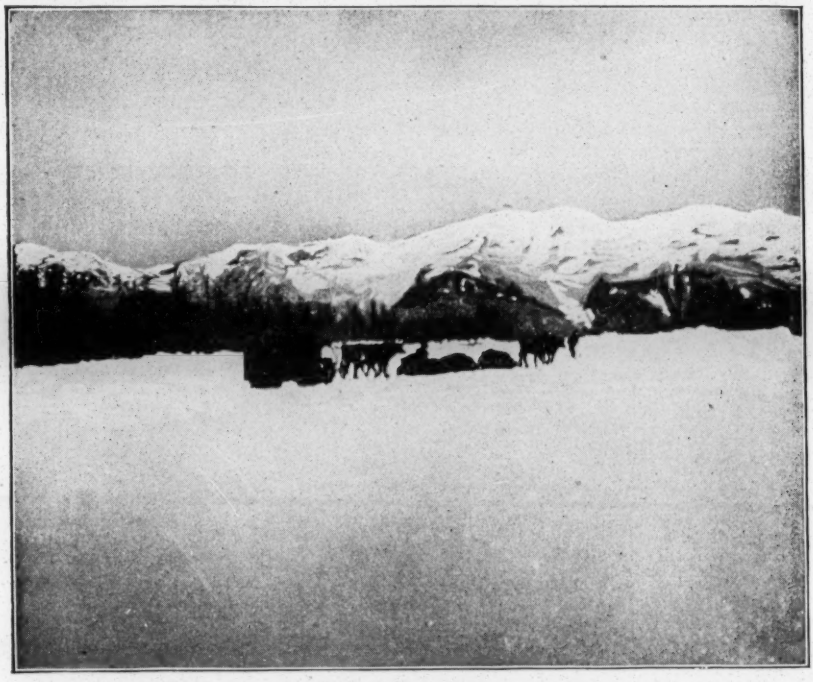
We were better equipped for making an expeditious journey up the river and soon the bulk of these fortune-seekers were left far in our rear. Our outfit consisted of a four-months' supply of bacon, beans, flour, baking powder, provender for the horses, and the usual camp impedimenta of tents and blankets. The entire outfit weighed about four tons. We camped on four feet

of soft snow and waited for the rain to cease in order to get out of the mild coast belt and proceed over the snow up the river. The few days of waiting on the island were enlivened by sights and incidents of some contemporaneous human interest. The place seemed to be a reservation for the exhibition of many amusing features of human crankery. All sorts of business ventures, more or less quixotic, were in evidence, from the saloon-keeper who intended to haul a barrel of whisky up the river on a hand-



STEAM LOCOMOTIVE ON RUNNERS — DESIGNED TO DRAW LOADED VANS OVER THE SNOW

sled to the man who was taking along a 60-foot steamboat in sections for launching on Teslin lake. One of the most extraordinary manifestations of genius for impracticabilities was Captain Armstrong's snow train. This was nothing less than a steam locomotive on runners, designed to draw heavily loaded vans of freight for 300 miles over the surface of the snow by means of a windlass and steel-wire cable carried ahead to anchorage. The snow train was hauled after incredible exertion eight miles up the river and there abandoned.



PLODDING UP THE STIKINE ON SLEDGES

During the early stages of the river journey we ordinarily made the morning start between midnight and two o'clock a. m., in order to get the advantage of an unbroken crust. It was dreary work plodding on by the creaking sledges several hours before daylight, the heavy snow of the broad river stretching out uninvitingly in the gloom before us like some gray morass. It was pleasant to think at these times that the whirling earth was bringing the genial sun flying across the continent; pleasant to think of Washington fully awake, of Chicago stirring uneasily in the sunrise of a new day. As our turn comes the forms of the giant peaks to the east gain detail and color in the gray pallor of the dawn. Soon the crests stand forth rosy against a pale pink sky-line, and tidings of coming day are flashed to the dark-green spruce forests that lie in shadow on the river's brink. With the sun fully above the mountain crests the glare in the valley becomes painful. The snowy expanse of the river and its mountain walls glitters and scintillates with cruel brilliancy. Every one becomes more or less affected with snow-blindness,

and complexions deepen into the hue and finish of red earthenware crockery. The writer's sleeping companion, John, the cook, introduced the device of daily blackening his face with soot from a charred fagot. It helped, he said, to soften the intolerable glare. Traces of these applications were visible upon a more or less wrinkled and pachydermatous face many weeks later.

About the middle of March we crossed the Alaskan boundary, 40 miles up the river, and two miles beyond passed the dead body of a man wrapped in canvas and strapped to a tree near the river's brink. Hard-by stood a hand sled and its empty harness. The gaunt stark figure and the motionless sled in the silent white desert told the brief story of the hope that had braved the wilderness and of the quest that had failed. We bivouacked nightly under the stars on the ice of the river. There was no unpacking of tents or removal of clothing. The tired men stretched themselves in couples upon a layer of blankets, over which were drawn more blankets and a tarpaulin, and were soon sunk in stertorous slumber. There were those in the party who could not sleep more than half the night while "lying out" on account of the cold. To crawl forth in the dead of the night from a heap of blankets in a semi-torpid condition for the purpose of thawing out by a painfully kindled fire was austerely somber work.

About 50 miles up the river the base of a great glacier was skirted, whose jagged billows of bluish ice silhouetted against a cloudless sky-line had been a sort of pillar of cloud by day for many weary miles of travel. The bunching of the boulders on the beaches and the plainly defined scratchings on the grim faces of the deeply serrated ridges testify to the sliding of a great ice-sheet in the remote ages of the past. The present-day glaciers, the lineal scions of this ice-mantle, lie anchored in splendid isolation upon the flanks of the lofty mountains that hem in the river. The course of the river through 200 miles of cross-ranges, that might not be inaptly termed the Cordilleras of North America, is contentious and turbulent, circumventing barriers by abrupt bends. About 95 miles upstream the pent-up current boils through a gloomy cañon not 100 feet in width, but ordinarily the stream flows composedly to the sea between banks that are anywhere from 300 to 3,000 feet apart.

The heaviest snow encountered on the river was in the Forty-mile stretch between Fifty-five mile camp and the cañon. The snow lay in great wind-driven dunes from bank to bank, often

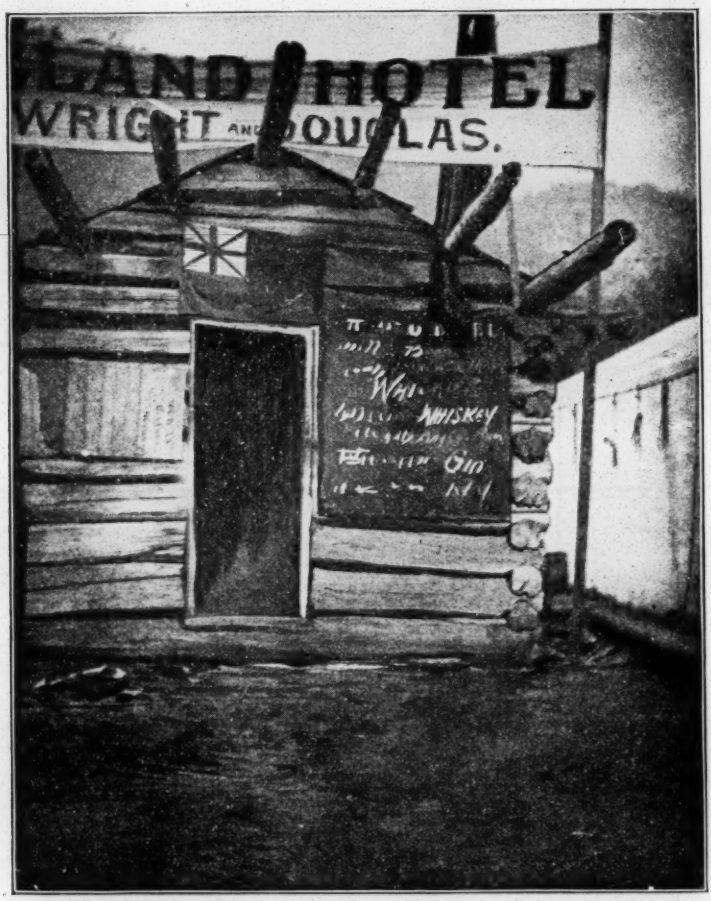
concealing thin ice. The ice varied from a few inches to four feet in thickness. At short intervals steel-pointed picket rods were thrust through the snow in advance of our heavy sledges, and the distance was covered in safety. Many outfits were lost through the ice in this stretch and six cases of death by drowning came to our notice.

Our outfit was well in advance of the bulk of the movement up the Stikine. Some light dog-teams had passed up the river a few days before, and the snow compacted by these sleds would ordinarily sustain the weight of our horses. The trail was a succession of heavy ruts and furrows; it was impossible for the horses to step to the snow on either side of the beaten track. The crust yielded even to the light cayuses or Indian ponies, and they floundered helplessly until lifted bodily back again to the trail. We struggled toilsomely through morasses of soft snow, tugging and heaving on the heavy sledges, while the teamsters urged on the discouraged horses. One Sunday, after making derricks of ourselves for half the day in our efforts to get the horses through heavy drifts, we hit upon the plan of drawing the beasts to a place of security on the sledges. The horses were accordingly detached, the loaded sledge drawn ahead, and the baggage removed. We then returned, and binding a worn-out horse securely to the top of the sledge, every man in the party laid hold of the tow-rope and tugged the beast up the river to where the stores had been deposited. Most of the men who had come thus far with horses had gone into camp on the river's bank in order to save the lives of their beasts. Little pools of blood along the trail marked the points where tired animals, cut by the crust, had been halted for a rest. The gaunt and wasted carcasses of dead horses and dogs by the wayside told the story of overwork and of exhausted food supplies.

On Tuesday, March 28, after three weeks of travel on the river, we rounded a bend of the stream and beheld Glenora. From Fort Wrangell to this point no settled human habitation had met the eye. Now we perceived that Callbreath's log-trading cabin and a dozen Indian shacks perched squat-like on a low margin of river bank formed the settlement that made so brave a showing upon the maps of that region. Two months later the Indian shacks had been turned into hotels and 15 saloons were doing a lively business. A local weekly newspaper was being hawked through the streets at 25 cents a copy. Outfits were

piled 20 feet high along the river front, and 2,000 white men lay camped behind this rampart of provisions.

It was dark when we reached Telegraph creek, our destination, 12 miles further up stream. Great hills rose sheer in rocky escarpments from the river, and there was no spot for a camping



LELAND HOTEL — GLENORA, B. C.

place on the small segment of soil at their base. There were no poles on which to raise our tents, no boughs on which to spread our blankets, no fuel for cooking the evening meal. We had labored unceasingly for 18 hours that day. Every one was tired and ill-humored. Blankets were unrolled in the dirty snow and

all sought repose—all but Dan, the axman, and John, the cook. They visited an improvised saloon that night, purchased Hudson's Bay Company rum, made acquaintances freely, and by morning had a considerable *clientèle* among the Indians.

Telegraph creek is an old trading center of the Hudson's Bay Company with the Tahltan Indians. A small creek pours through the rocky defiles of the mountains into the Stikine at this point. There is not a telegraph line in 1,000 miles. The name, however, recalls the enterprise of connecting the Old World with the New by a cable across the Bering sea. Work was actually begun on stringing the overland wire through this regi on, and great coils of rust-eaten wire still lie on the banks of the Stikine, precisely where they were dropped when the successful laying of the Atlantic cable killed the western project.

The Tahltan Indians about Telegraph creek speak Chinook and understand some of the most ordinary English words or speech of "Boston men." The rich and aristocratic, whose fortunes were laid in the packing industry twenty years before, in

TELEGRAPH CREEK — 150 MILES UP THE RIVER FROM WRANGELL, ALASKA

the days of the old Cassiar gold excitement, live in comfortable log rancheries near the water's edge. The unthrifty, owning neither cabins nor ponies, live back in the brush in wickiups or hovels of poverty.

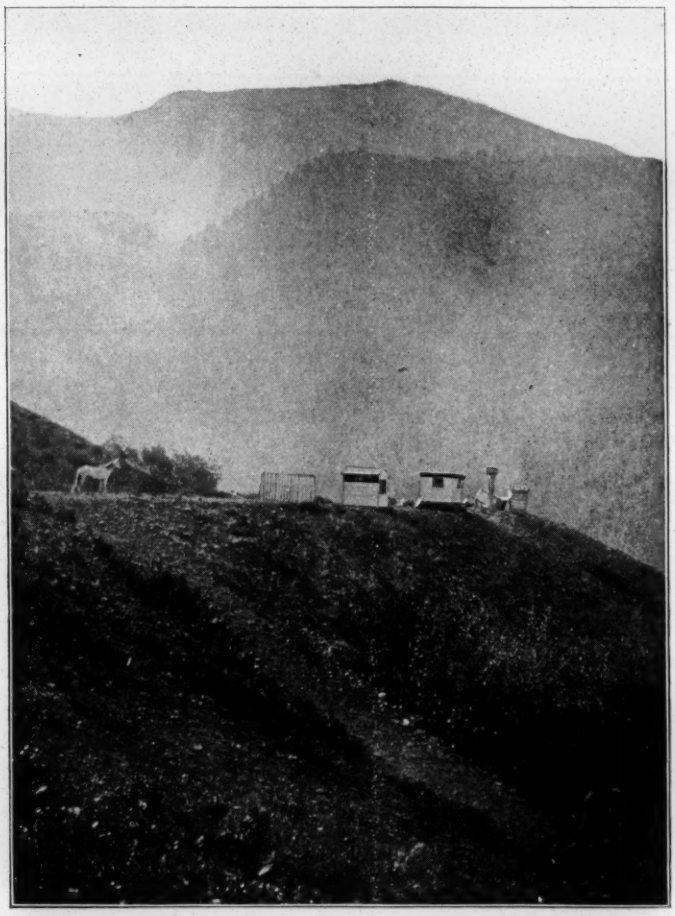
Social lines are strictly drawn. The ownership of a log cabin marks class divisions. Another badge of distinction lay in the possession of gaily beribboned straw hats. These hats had been taken into the country the previous autumn by the Hudson's Bay Company. Any young buck who aspired to be anything at all contrived to wear a straw hat last winter. Preference ran to Princeton colors. The Klooches, or women of the tribe, had a passion for gay-colored dress and were especially fond of dancing.

The family life of the Tahltans is of a low order. These people have not emerged from a state of polyandry. Paternity being a matter of doubt and maternity a matter of fact, the tracing of relationship among them is confined rather closely to the female line. Of course this has a direct influence upon property rights. Among Indians of the same tribe of the Tahltan river the institution of *mutter recht* or mother-law is clearly defined. The children of a marriage belong to the mother's family. It is said that in rare cases a child is transferred to the father's side of the house through formal adoption for a brief period by the father's sister. In the matter of inheritance it is the sister's son who takes precedence over the wife as a man's natural heir, though when a man dies his friends take over pretty much all his portable property. The wife, however, receives some compensation in the distribution of presents at the next *potlatch* or memorial festival, at which the deceased is honored. A trace of exogamy and of marriage by capture still exists in the feigned pursuit of a bride by the intended husband. The hostile demonstrations against the captor made by the friends of the bride are significant only of mock anger, being a relic of the archaic usage of hurling real weapons in actual wrath at the retreating bridegroom. Our own civilization has advanced a step farther. Rice and old slippers are thrown at bridal couples without even the affectation of wrath.

One would expect from their crude ideas of marriage to find a condition of club law or of lawlessness among the Tahltans. This is not true. They have scrupulous respect for rights of person and property. Of the many tons of food supply left unguarded along the trail we did not hear of a single case of theft by hungry

Indians. Prices, too, were high in the region of Telegraph creek before the break-up of the ice and arrival of river steamboats. Flour and bacon sold for 50 cents per pound, and one ton of hay could have been sold for $500.

There is some novelty in the method by which the Tahltans



INDIAN CABINS FOR THE DEAD — TELEGRAPH CREEK

dispose of their dead. After the flesh has been burned from the bones on a funeral pyre, with the favorite weapons and ornaments of the deceased, they are packed in small tin-covered trunks furnished by American traders. The trunks are then placed in neatly constructed cabins with glass windows. The

cabins of the dead perched upon Mameloose hill, 200 feet above the river, can be seen for three miles down the stream. One little trunk, scarcely larger than a physician's medicine chest, was housed under a diminutive canvas tent. Few of the living Tahltans possess glass windows in their cabins, but these luxurious accessories are furnished the dead, whose spirits, with proverbial Indian curiosity, are supposed to be on the lookout for interesting phenomena in the village below. And since the world began was there ever so much to thrill the imagination of those simple folk of the forest as the phenomena provided by the gold-seekers last spring!

Gold hunting has no fascination for the natives of these regions, and they have never worked the old placer grounds in the vicinity in search of it. It must have seemed to them that all white men had suddenly gone mad. The sudden irruption into the solitudes of a far country of hundreds of swarthy men with horses, bullocks, goats, dogs, and impedimenta by the ton, amused the simple natives in much the same way as children are pleased at the antics of a menagerie of performing animals. All day long the bucks, wrapped in Hudson's Bay Company blankets, sat stolidly upon piles of lodge-poles on the bank, absorbed in the contemplation of the busy scenes on the river. They were amazed at the prodigious quantity of supplies; they marveled at the energy which had braved the snows of the river, but all shook their heads discouragingly at the project of taking the heavy outfits over the mountain trail into the interior. From being objects for the satisfaction of curiosity merely, the strangers became objects for the gratification of avarice. These untutored savages are shrewd and Shylockish in their keenness after a bargain. The prices the noble red men put upon their wares or their services were perfectly ridiculous. Ten dollars for a pair of moccasins and $20 for a day's labor at packing were gravely demanded of the strangers. Prices were finally scaled down to a basis of $150 per ton for packing to the first summit of nine miles. At this rate an Indian with his pony could earn from $15 to $18 per day. The Indians suffered economically as well as morally through their fondness for strong drink. Much bad whisky was quietly exchanged for their services. Our cook fixed up a decoction of lemon extract and dark water in which tea leaves had been steeped. Brown sugar and a dash of pepper were added to the mixture. The stuff was put up in old bottles

PACK TRAIN ASCENDING TO FIRST SUMMIT — TESLIN TRAIL

and slyly traded to the Klooches in exchange for moccasins and leggins as a highly prized brand of American wine.

As we broke camp to begin the nine-mile climb to the first summit, three of our men rolled their blankets and bade us farewell. Their secession was due to unpleasantness over the duties of flunky to the cook, for which seven of us had been detailed. "We did not come into this country to act the part of scullion to a sheep-herder," said they. So they left the party to become professional packers, which is harder on one's back, but not so trying to one's pride. Soon after this John, our ingenious cook, left the party as a result of a little unpleasantness with Dan, the

axman. John had made soup of some moose bones purchased from the Indians, in an old lard can that "Calgary," the teamster, had used the day before as a wash-boiler for his month's laundry. Dan would eat no soup, remarking that "when a man became too dirty to drive sheep he still had a chance of going in to cook on a survey corps." This sinister reference to John's former occupation broke the *entente cordiale.* John secretly disposed of about $200 worth of our provisions to some gold-seekers and departed for Glenora to start in business as a professional poker player. His place was taken by a stranded gold-seeker

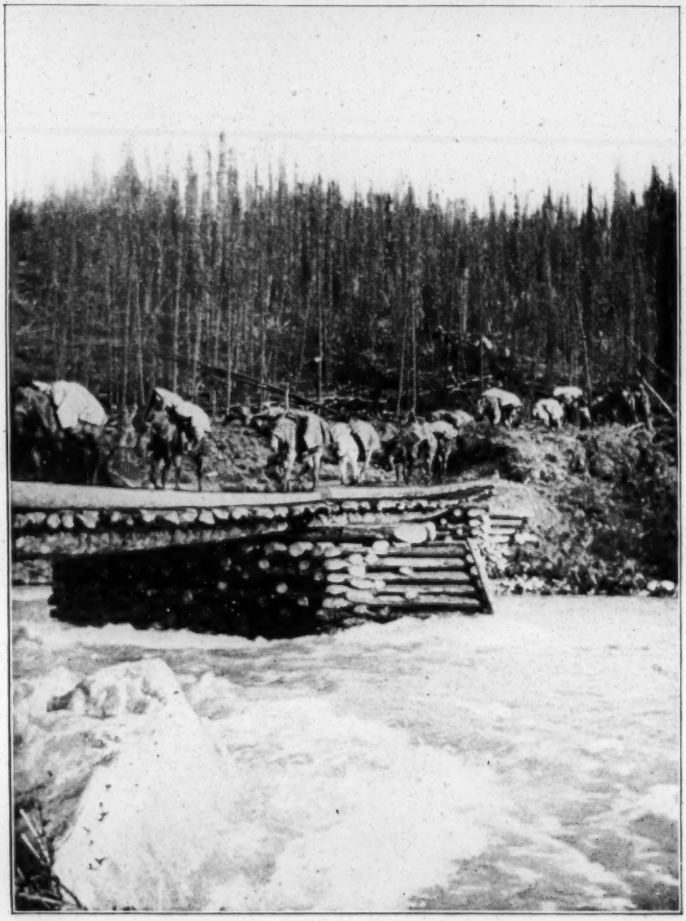
CAMPING ON THE FIRST SUMMIT — ABOVE TELEGRAPH CREEK

called Ben, who approached the subject of cooking without any preconceived opinions or errors in experience.

On quitting the rivers we followed the roaring mountain torrent that threads its way from the first summit nine miles to the northward. By noon of the second day we stood upon the first divide, at an elevation of about 2,700 feet above Telegraph Creek village. In this distance we had lifted and tugged the sledges over a succession of benches that rose *échelle*-wise in formidable declivities from the river. A bitterly cold, searching wind was encountered on the summit, and we could not halt for

lunch or rest. Over the divide the country gently falls off toward the valley of the Little Tahltan, about 16 miles to the northeast, from which low level another summit of 2,600 feet is to be surmounted in the ensuing 12 miles of trail to the Coketsie lakes.

Just beyond the first summit we were caught in a heavy snowstorm, thick with fine, driving snow. The men who worked at the sledges to keep them on the narrow, tortuous trail could scarcely distinguish the driver who led the horse. The horses repeatedly lost footing on the beaten path, and fell plunging and snorting over their withers in the dry, powdery snow to one side. As we could not push on to a suitable camping place and the



IMPROVISED BRIDGE OVER LITTLE TAHLTAN RIVER — TESLIN TRAIL

horses could not remain on the narrow trail through the stormy night, the sledges were detached and the beasts sent back to the south slope of the divide.

The snow lay seven feet deep over the stunted willows that grew about the little mountain stream we were following to the Tahltan. This stream was located and a shaft was sunk through the snow and ice to the running water. Pails of water were thrown upon the dry granulated snow in order to get a substantial flooring for a single tent. After four hours of work, seven men managed to find shelter from the storm. The draughtsman who had begun to doubt the wisdom of continuing with the party recovered his confidence; but in this auspicious hour our little sheet-iron stove becoming hot keeled over on its foundation and settled two feet in the snow. This separated the stove pipe at one of its joints, and a dense cloud of smoke filled the once happy home. It was a case of *sauve qui peut.* Every one fled to the open air; but above the howling of the storm an oversensitive ear might now have caught certain lurid epithets and objurgations that only an extraordinary exigency serves to invoke from the vocabulary of the habitually profane.

[*To be concluded in the November number.*]

TIDES OF CHESAPEAKE BAY

By E. D. PRESTON,

U. S. Coast and Geodetic Survey

A successful attempt to fix a permanent tidal plane for the Chesapeake bay has recently been made by the U. S. Coast and Geodetic Survey. During the last fiscal year nearly 40 stations were occupied, at 13 of which we are in possession of simultaneous tidal observations extending over one complete lunation.

The application of harmonic analysis to this unique series along our seaboard will open the way for correct predictions from the capes to Havre de Grace, and will also result in the establishment for the whole bay of a plane of reference of unequaled permanence and undoubted accuracy. The establishment of an invariable datum plane is one of the first requisites of inshore hydrography. The accuracy with which such reference level should be determined depends, of course, on the nature of the work based upon it. In foreign surveys vast sums have

been expended in maintaining tide-measuring instruments in the North sea, along the coasts of France, and in the Mediterranean sea. These have been connected, wherever possible, in efforts to compare the sea-level at different ports around Europe. France and Spain occupy favorable positions in work of this kind, since by comparatively short lines, without leaving their own territory, they may connect the mean sea-levels of the Atlantic and the inland waters east of Gibraltar. How important the determination of heights is regarded abroad may be judged from the fact that up to 1895, the date of the last published report of the International Geodetic Association, more than 122,000 kilometers of precise leveling had been done in continental Europe, and nearly 99,000 permanent bench-marks had been established. This work has had its greatest development in Germany, Austria, and France, in the order named.

The average tide for the entire bay is about one foot; possibly less. For Old Point Comfort we have two and one-half feet; for the mouth of the Potomac, one foot; for Washington, three feet; Richmond, three feet; Elk river, at the head of the bay, two feet, and Annapolis less than one foot. The wind effect, however, is sometimes more than the total tide. For example, at Baltimore the wind effect may amount to three feet, while the tide proper, uninfluenced by local disturbances, is only one-third as much. This diminution in the height of the tides as we come northward from the entrance and the subsequent increase as we continue on in the same direction is one of the peculiar features of the tidal phenomena of the bay.

The small range at Annapolis is due partly to the change in width of the bay, but principally to the fact that there is an interference at this point between the incoming and outgoing tidal waves. When the crest of the southbound movement reaches the mouth of the Severn river it meets the northbound wave from the capes, and a partial neutralization of the vertical motion of the water takes place. Another interesting point in connection with the subject is that the rate of progress of the tidal wave from the mouth of the Potomac to Washington is somewhat less than that of an ordinary steamer, so that a vessel requiring the greatest depth possible would be able to enjoy the condition of high water during its entire passage up the river. The fact was first brought out by Mr C. A. Schott many years ago, when the *Great Eastern*, of transatlantic cable fame, availed itself of this favorable circumstance and came to anchor within a few miles of the Capitol.

THE RELATION OF FORESTS AND FOREST FIRES

By GIFFORD PINCHOT,

Forester of the U. S. Department of Agriculture

The study of forest fires as modifiers of the composition and mode of life of the forest is as yet in its earliest stages. Remarkably little attention, in view of the importance of the subject, has hitherto been accorded to it. A few observers who have lived much with the forest, such as John Muir of California, have grouped fire with temperature and moisture as one of the great factors which govern the distribution and character of forest growth; but so little has been said or written upon the subject that the opinion of each man seems to have been reached independently and upon the single basis of personal observation. The documents upon the subject still reside, with very few exceptions, in the forest itself. It is unfortunate that our acquaintance with what might almost be called the creative action of forest fires should be so meager, for only through a knowledge of this relation and through the insight which such knowledge brings can there be gained a clear and full conception of how and why fires do harm, and how best they may be prevented or extinguished.

The records of past fires, written in the forest now on the ground, are often decipherable for more than a hundred years back, and in many cases for more than twice that length of time. Such records throw light on the relations of forests and fires as nothing else can, and are consequently the most valuable of all documents upon the somewhat intricate but most important question of the final effect of fire upon the forest; for we must clearly realize, before the present subject can fall into its proper sequence, that we have not stated everything when we say that "a given forest is destroyed by fire." The forests which the first white explorers saw as they landed on this continent and gradually overran it were themselves the successors of others, which, through thousands of years, were burned down at intervals that we can no longer trace. There is but little of all the vast forest area of this country which does not bear, either in actual scars and charcoal or in the manner and composition of its growth,

the marks of fire, and indeed it is more than probable that further investigation will greatly narrow the limits of those portions which may now seem to have been exempt.

That fires do vast harm we know already, although just what the destruction of its forests will cost the nation is still unknown.

FALLEN AND STANDING FIRE-KILLED TIMBER READY FOR THE NEXT FIRE — PRIEST RIVER FOREST RESERVE, IDAHO

From "A Primer of Forestry"

Records compiled by the Division of Forestry indicate that the average direct recorded loss from this source is not less than $20,000,000 a year. To this figure must be added the vast direct loss unrecorded, together with a great but indefinite damage from the effect of forest destruction on water supply, and other

losses of immense importance, the deterioration of the soil, the destruction of the young growth, and the loss of the increment which a healthy young forest would have been laying on year by year. The latter may commonly amount in a pure forest to several hundred board feet per acre each year. With further study a more exact statement of the grand total of the loss will be possible; but even now it is safe to assume that for the nation as a whole the loss is represented yearly by a sum much in ex-

A SLASHING BEFORE THE FIRE — THE MASS OF DEBRIS IS TOO THICK TO PERMIT REPRODUCTION — WESTERN WASHINGTON

cess of $50,000,000. That figure sufficiently proves that the destructive action of fire on the forest in its relation to human needs is a subject of the first interest and importance; but in the present paper this brief reference must suffice. The regulative action of fire on the forest is here more directly in question.

Fires determine the presence or absence of forest in a given region far more generally than is often supposed. A very large part of the prairie regions of the United States is treeless probably because of fire. Such evidence as we have points strongly

FIRE GLADES SURROUNDED BY FIRE-SCARRED TIMBER ON HIGHER GROUND — BLACK HILLS, SOUTH DAKOTA

in this direction, and in addition the behavior of the border forest lands along the eastern edge of the prairies powerfully confirms this view. Where such forest lands have been protected from fire, as they have very largely through the progress of settlement, young trees have usually sprung up in great numbers under or between the scattered veterans which had survived the fires, and a dense and vigorous young growth stands ready to replace by a heavy forest the open park-like condition which the fire had created and maintained. The well-known "oak openings" furnish an excellent case in point. In a similar way and for similar reasons trees are spreading from the borders of streams in the prairies to the grass lands near by. Such indications as these, joined to the occasional discovery of evidences of former tree growth out on the prairie, where trees no longer grow, go far to prove that trees once grew and may grow again much beyond the limits they occupied when the white men first entered the country. That fire was a restraining cause admits of no doubt whatever, and that it was the principal cause over vast areas is

altogether probable. One set of facts which may ultimately be used to establish this latter contention is found in the positions chiefly or exclusively occupied by trees in semi-arid regions, which positions are either along water-courses, and so shielded from fire by moisture, or on rough and stony ground, and so protected by the absence of enough grass or other vegetable ground-cover to carry a destructive flame.

The same course of reasoning applies to certain kinds of open glades or prairie, well named "fire-glades" by Mr Frederick V Coville, Botanist of the U. S. Department of Agriculture. In the Black Hills of South Dakota, for example, these glades, surrounded by forest-bearing land, are almost exclusively confined to ground rich enough to support a crop of grass sufficiently dense to burn fiercely, while the timber is restricted to rough rocky or stony land, almost always higher than the glades and comparatively safe from fire because of the scantiness of the minor vegetation it is able to support.

In semi-arid regions where fire-glades of this kind occur, there is an interesting alternation, by years or series of years, of the presence and absence of the moisture which makes forest reproduction possible. In the same way the occurrence or absence of burning gives or denies an opportunity for young seedlings to reach a size at which they are reasonably safe from the attacks of ordinary surface fires. It must be clearly borne in mind that it is only the average effect of the class of causes of which fire and rain are the chief with which we are concerned. Young trees sometimes succeed through combinations of temporary immunities in establishing themselves in the midst of fire-glades of old date, and the rocky refuges where some seedlings usually escape the fire are not uncommonly burned over, as the fire-scarred trunks abundantly testify. But these facts do not obscure the effective working of the averages, although they do tend powerfully to lengthen the time required for the average to work itself out. Thus reproduction around the fire-glades of the Black Hills is extremely slow.

Perhaps the most remarkable of the regulative effects of forest fires relates to the composition of the forest—the kinds of trees of which it is composed and the proportion of each. This effect depends upon the action of fire in combination with the various qualities of resistance which trees possess. These qualities are of two chief kinds; one, adapted to secure the safety of the individual tree directly through its own powers of defense, the

other to assure the continuance of the species, with little regard for the single tree. An example of the first kind is the western larch, whose enormously thick bark is almost fireproof, and so good a non conductor that it protects the living tissue beneath it even against fires hot enough to scorch the trunk 50 or 75 feet above the ground. It is to this quality of their bark, as well as to their marvelous vitality, that the big trees of California owe their power to reach an age of 3,000 or 4,000 years. The eastern pitch pine protects itself in the same way. So do many other trees, including the longleaf pine, which adds to this quality of its bark another method of protection that places it at the head of all the trees of my acquaintance in its capacity to resist fire.

Almost all trees yield readily to slight surface fires during the first ten or fifteen years of their life. To this statement the longleaf pine is a conspicuous and rare exception. Not only do the young trees protect themselves in early youth by bark which is not uncommonly as thick as the wood (the whole diameter being thus two-thirds bark and one-third wood), but they add to this unusual armor a device specially adapted for their safety when growing amid long grass, usually a most fatal neighbor to young trees in case of fire. It is to be noted that the vast majority of longleaf pines are associated with grass from the beginning to the end of their lives. During the first four or five years the longleaf seedling reaches a height of but four or five inches above the ground. It has generally been erroneously assumed that this slow growth made it specially susceptible to injury from fire; but while the stem during these early years makes little progress, the long needles shoot up and bend over in a green cascade which falls to the ground in a circle about the seedling. Not only does this barrier of green needles itself burn only with difficulty, but it shades out the grass around the young stem, and so prepares a double fire-resisting shield about the vitals of the young tree. Such facts explain why the fire which has restricted the spread of evergreen oaks in parts of Florida, for example, has made a pure forest of pines in a region where the reproduction of the oaks is phenomenally rapid wherever the annual fires cannot run.

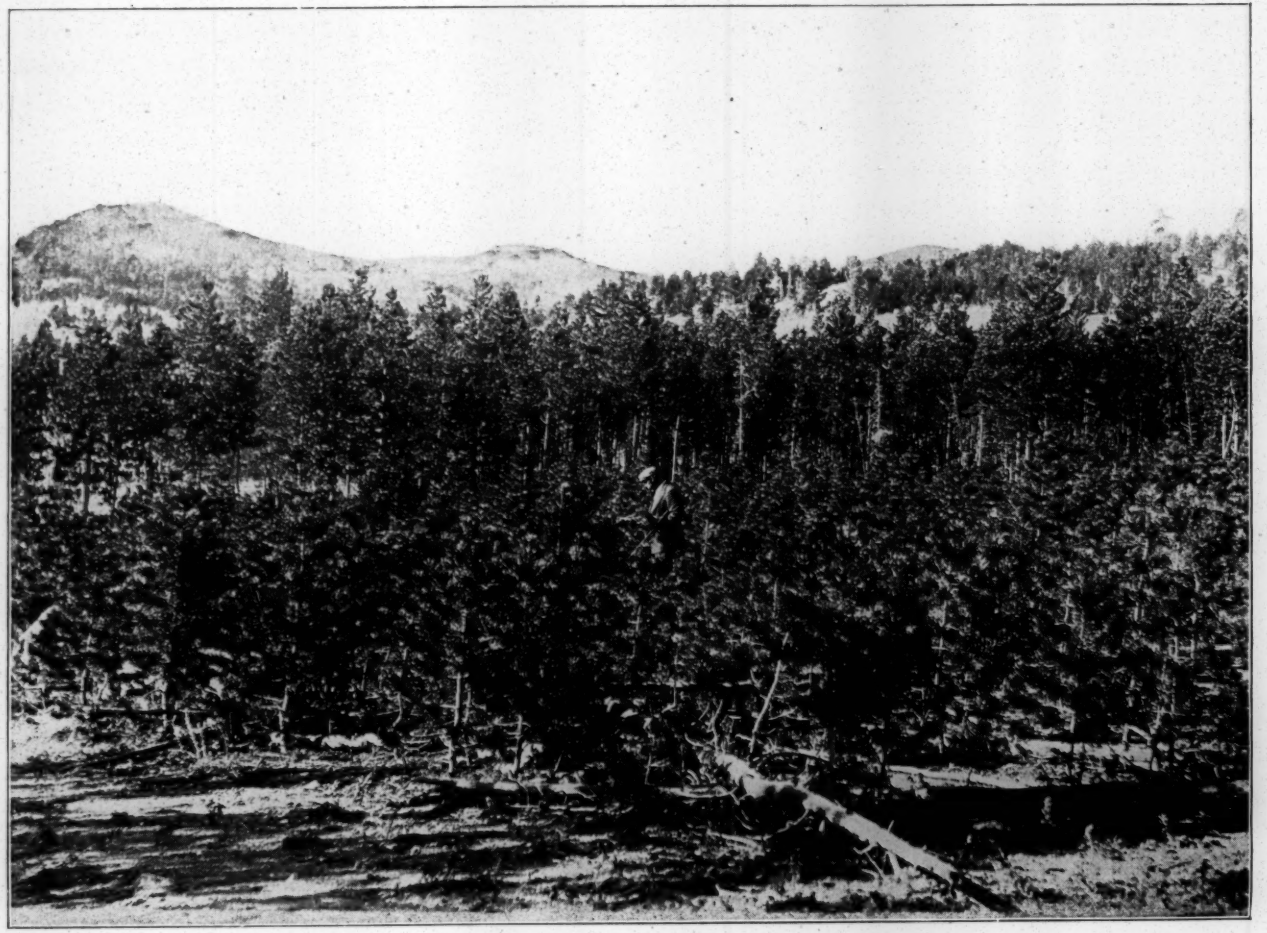
The second method of protection against fire is that which sacrifices the individual but secures the safety of the species. Perhaps the most striking example of this method is furnished by the lodgepole pine, which is being distributed over hundreds

of square miles in the Rocky Mountain region by the action of fire. It is a fact that this thin-barked tree, which succumbs with the utmost readiness to fire, is gaining ground by the action of its enemy, replacing over great areas thick-barked species like

FIRE-SCARRED SEEDLING OF LONGLEAF PINE — SHOWING PROTECTING NATURAL GROWTH OF ITS NEEDLES

the red fir and the western larch. The device to which this curious result is due is similar to that of *Pinus attenuata*, to which John Muir long since called attention.* It consists in the hoarding for several years of the ripe seeds in the cones. Fire rarely

* See The Mountains of California, p. 151.



TWO GENERATIONS OF LODGEPOLE PINE IN EVEN-AGED GROWTH AFTER FIRE — THE GROUPS ARE TWELVE AND FIFTY YEARS OLD RESPECTIVELY

burns down the lodgepole pine, but in nearly every case simply kills the standing tree and leaves it to be blown down years after, when decay shall have weakened the roots. In the meantime the hoarded winged seeds are set free by the opening of the cones, are distributed and germinate, and the new crop contains a larger proportion of lodgepole than the old. By the repetition of this process great stretches of burned land are finally covered with a pure even-aged young growth where formerly the forest was composed of other and usually much more valuable species. The details of the return process by which the more valuable species will undoubtedly in the end regain possession of the soil I do not yet know.

A somewhat less obvious, although not a less interesting, instance of distribution controlled by fire is that of the red fir in those portions of Washington (and presumably of Oregon also) where it reaches its best dimensions and greatest commercial importance. Here the young seedlings are found in remarkable abundance on unshaded spots wherever the vegetable covering of the mineral soil has been burned away. An actual count

UNSCARRED EVEN-AGED YOUNG GROWTH OF RED FIR — SHOWING FIRE-SCARRED ROTTING STUBS OF THE PREVIOUS GENERATION — OLYMPIC FOREST RESERVE

and measurement of every tree on many hundred acres of fir timber in various parts of the Puget Sound region, and a study in the Olympics, combine to show them practically absent in the shade of their elders. In the latter region, as I had occasion to say in a report (dated January 26, 1898) to the Secretary of the Interior on the condition and proper management of the national forest reserves, "Continuous stretches of miles without a break were covered with a uniform growth of Douglas fir (red fir) from two to three feet in diameter, interspersed with numerous rotting stumps of much larger trees bearing the marks of

REDFIR FOREST ON LAND ONCE RAVAGED BY FIRE

fire. The young firs were entirely unscarred, but charcoal was found at the roots of some specimens which had been thrown by the wind. . . . Charcoal was found directly beneath a growing cedar tree four feet in diameter, under which a hole had been excavated in the course of lumbering operations. This mass of evidence acquires a crucial importance with relation to the forest from the fact that in my ten days' visit to this region I did not see a single young seedling of Douglas fir (red fir) under the forest cover, nor a single opening made by fire which did not contain them." In a word, the distribution of the red fir in western Washington, where it is by all odds the most

valuable commercial tree, is governed, first of all, so far as we know at present, by fire. Had fires been kept out of these forests in the last thousand years the fir which gives them their distinctive character would not be in existence, but would be replaced in all probability by the hemlock, which fills even the densest of the Puget Sound forests with its innumerable seedlings. I hasten to add that these facts do not imply any desirability in the fires which are now devastating the West.

These examples of the relations of fire and the forest are cited because they are conspicuous among the few which have already been worked out. Without question a number of relations of vastly greater importance remain to attract and reward the student of this branch, one of the most fruitful and fascinating of all the fascinating and fruitful branches, of forestry in the United States.

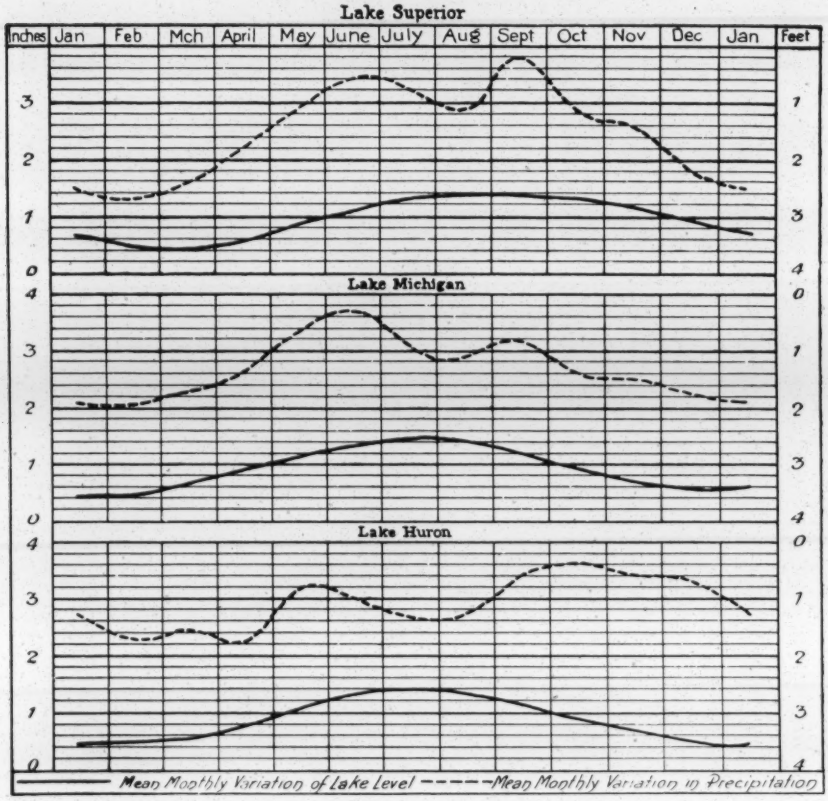
VARIATIONS IN LAKE LEVELS AND ATMOSPHERIC PRECIPITATION

By Alfred J. Henry,

Chief of Division of Records, U. S. Weather Bureau

A study of the fluctuations in the surface level of the Great Lakes is always an interesting problem. It is especially so at the present time, owing to the near completion of the Chicago drainage canal and the projection of various industrial enterprises, which, when completed, will divert large quantities of water from present channels. The physical problems involved in an adjustment of the situation are manifold and intricate, as are also the commercial interests seeking recognition. The writer desires at this time, however, merely to direct attention to the possibility of determining the probable level of the lakes by accurately gauging the precipitation over the various watersheds.

The stage of water in a river or natural reservoir system, such as the Great Lakes, is dependent primarily upon supply, discharge, and evaporation. In small streams the correspondence between precipitation and water stages is easily observed. The drainage basins themselves are small, and when precipitation has once begun but a short time lapses before all portions of the basin are contributing to the stream-flow. In a small basin of uniform surface and slope it is possible to calculate the exact



MEAN MONTHLY VARIATION IN LAKE LEVELS AND PRECIPITATION

time of maximum stage providing the amount and intensity of precipitation are known. As the drainage basin increases, however, the problem becomes one of greater complexity and the correspondence between precipitation and water stages is not so definitely marked.

The important oscillations in the surface level of the Great Lakes may be conveniently divided into two classes, *viz.*, annual or periodic, and irregular or non-periodic. The first of these consist of a rise from low water of winter to high water of midsummer, followed by a return to low water, the entire range from low to high water rarely exceeding a foot. The irregular or non-periodic variations also consist of oscillations up and down about a general mean level; but, unlike those first named, they may range through several feet and persist in a single direction for a number of years. Lakes Michigan and Huron, it may be re-

membered, fell continuously from 1886 to 1892, the total fall being about two and a half feet.

The mean monthly variation, both in lake levels and monthly precipitation over the respective watersheds, is shown in the diagram on page 404. The full curve shows the average level in feet of the surface of Lakes Superior, Michigan, and Huron below the plane of reference of the U. S. Lake Survey (high water of 1838). The dotted curve shows the average distribution of precipitation, in inches, throughout the year. The agreement between the two sets of curves is as close as could be expected, considering the nature of the data on which they are based and the natural climatic differences between the regions under discussion.

The climate of the Lake Superior watershed differs in several respects from that of the region to the southward, partly by reason of its geographic position and partly on account of the lake itself. The precipitation of winter is generally in the form of snow, and is derived for the most part from storms advancing from the North Pacific or the Canadian Northwest. The snowfall is greatest on the south shore of the lake and is particularly heavy from the Keweenaw peninsula eastward to and beyond Wetmore, on the Duluth, South Shore and Atlantic railway.

If the two curves showing the monthly rise in the level of Lake Superior and the distribution of precipitation in its watershed respectively be compared, it will be seen that the annual rise in the lake begins coincidently with an increase of precipitation. We should not be too hasty in placing these phenomena in the relation of cause and effect. The rise in the waters of the lake in the spring is doubtless due to the breaking up of the ice in the rivers and the melting of the snow. Water from these sources is fed into the lake during April and May more rapidly than it is discharged through the St Marys river; hence the surface level rises. The rains of June, July, and August, on the average, equal about nine inches in linear depth, which amount, plus the run-off from the watershed, should be set against the loss by evaporation. The latter is, to a certain extent, an unknown quantity, varying somewhat from year to year. Under the most favorable conditions the loss by evaporation will not greatly exceed the rainfall. The height to which the water of the lake will probably rise, therefore, must depend greatly upon the amount of water carried by the tributaries of the lake after the breaking up of the ice, plus the amount conserved during the spring and early summer in the swamps and forested areas

within the watershed, and this in turn is largely dependent upon the amount of snowfall during the previous winter and the manner of its disappearance.

The present season has been one of abundant rainfall on both sides of the international boundary, north of a line drawn through Alpena and Parry sound. South of that line the rainfall has been deficient. The water of Lake Superior has been higher than usual, and there has been an increase in water levels of Lakes Michigan and Huron also, although rainfall over a large portion of the watersheds of the lakes last named has been deficient.

This is an important fact, since it suggests at once the probability that the stage of water in Lakes Michigan and Huron is controlled in great measure by precipitation in the Superior basin. The number of rainfall stations reporting to the Weather Bureau from the lake region is about 300. It should be possible in the course of a few years to define in at least approximate terms the relations which subsist between atmospheric precipitation and fluctuations in the level of the lakes.

CALCULATIONS OF POPULATION IN JUNE, 1900*

By Henry Farquhar,

Statistical Expert, Division of Statistics, U. S. Department of Agriculture

The problem to be discussed in this paper may be stated as follows: Given the population of the United States (not including recent territorial extensions) for the first of June in each tenth year; given also the total immigration to the country for the several decades beginning with 1821 and ending with 1900; to conclude from those data the population probably to be returned for the same territory for the first of June next year. In using the decennial population figures, those for 1870, confessed by General Walker himself to be several hundred thousand short of the truth, are omitted. The immigration for the fiscal year just begun has necessarily to be estimated in calculating the increase from 1890 to 1900; otherwise the official returns constitute the data of the problem.

Immigration.—The annual figures are given by fiscal years ending with September from 1820 to 1849, with the exception of

* Read before Section I of The American Association for the Advancement of Science, Columbus, August 22, 1899.

the years 1832 to 1842; then from 1850 to 1865 the year of the immigration report closes with December; from 1866 to date the fiscal year ending with June is adopted. To make the figures homogeneous, the earlier returns are approximately reduced to years ending with June by adding and subtracting, for the fiscal year of each decade, a proportion of the immigration equal to the proportional part of the year between the end of June and the end of the immigration year adopted; that is, one-fourth if the latter ends with September, one-half if with December. This approximate reduction would be exact if immigration during the year so divided were precisely uniform. The assumed immigration for the present fiscal year, 354,000, is larger than that reported for any year since 1893, though considerably less than for the first three years of the decade. The last decade, however, shows but one year, that ending June, 1886, when the immigration was less than 354,000.

Immigration by Decades, and Reduction to Years Ending with June.

Decade begins.	Reduction to July.	Decade ends.	Reduction to June.	Total immigration.	Reduced immigration.
Oct., 1820	+ 2,100	Sept., 1830	— 5,800	143,439	139,700
Oct., 1830	+ 5,800	Dec., 1840	— 42,000	599,125	562,900
Jan., 1841	+ 42,000	Dec., 1850	— 148,000	1,713,251	1,607,300
Jan., 1851	+ 148,000	Dec., 1860	— 75,100	2,579,520	2,652,400
Jan., 1861	+ 75,100	June, 1870	0	2,298,596	2,373,700
July, 1870	0	June, 1880	0	2,812,191	2,812,200
July, 1880	0	June, 1890	0	5,246,613	5,246,600
July, 1890	0	June, 1899	+ 354,000	3,396,011	3,750,000

Natural Increase.—It need hardly be confessed that to take the difference between the population at the beginning of June for years ten apart, to diminish that difference by the immigration for a ten-year interval reaching forward to the end of the same month, and to treat this diminished difference as the natural increase for the decade of the population reported at the beginning, is not a procedure that should be employed in a calculation where any great refinement is admissible. Unfortunately, in this case our data do not admit of delicate handling. The most important error involved in this treatment is probably that of neglecting the increase in the immigrant population itself

from the time of landing to the end of the decade. If allowance were made for such increase, it would result in a slightly smaller estimated population for the first day of June next. The correction is here neglected for four reasons: (1) its uncertainty—for the assumption that an immigrant population, immediately after arrival, will increase at the same rate as natives is only approximately true, and there is no trustworthy way of tracing this element of the population from census to census; (2) the smallness of the amount involved—no reasonable estimate of the increase in question for any decade, even that beginning with 1880, would reach half a million, by but a very small fraction of which amount the final result for 1900 could be affected, a fraction insignificant when compared with errors unavoidably entering; (3) the desirability of simplicity in the calculation, as well as definiteness; (4) the probability that the discordance between the 1880 and 1890 census figures, brought out by the application in the formulæ herewith to be shown, is due more to deficiency of the latter rather than to excess of the former, so that any treatment which, using the figures as they stand, leads to a lower final result for 1900 is to be avoided. The "natural increase," therefore, as here understood, is the total increase during the decade by census record, diminished only by the accession from immigration in that time.

Law of Natural Increase.—In a newly occupied territory the tendency of a population is to grow in a geometrical progression; the percentage of increase is in that case constant for a constant interval, and the total population equal to some fixed quantity raised to a power represented by the time. After a period, longer or shorter, according to the capacity of the population to support itself on the land, the percentage of increase falls off and grows lower as the population grows greater. The law of this falling off in the ratio is one which, in the present state of our knowledge, has to be decided empirically. The following formula is used, with some modifications to be explained, in these calculations:

$$\Delta p = \frac{p}{e + fp + gp^2},$$

where p denotes the population, Δp its natural increase in ten years, and e, f, g positive constants to be found by calculation. It will be seen that this formula would give a geometrical progression if f and g were zero; that it gives a near approach to such a progression for small values of p; that Δp would contin-

ually increase (thus showing always larger additions per decade) and approximate to an arithmetical progression with common difference equal to $\frac{1}{f}$ for very large values of p if g were zero; that without any such supposition Δp increases in value as long as p is less than $\sqrt{\frac{e}{g}}$, but decreases when p exceeds $\sqrt{\frac{e}{g}}$; and that the effect of the constant g is to make the population, when it becomes very large, nearly proportional to the square root of the time elapsed. If Δp is taken as a differential coefficient, it is easy to deduce a value of the time in terms of the population, involving the logarithm of p as well as its first and second powers; but a statement of p in terms of the time seems to require a series to express it. To treat Δp as a difference instead of a differential only introduces further complexities, so that it will not be worth while to go further into the mathematical discussion of the formula.

For convenience the constants f and g are made to apply to a population in millions, a million inhabitants being taken as a unit in the calculation. The table to be shown is constructed accordingly. To apply to natural units, f would have to have six ciphers prefixed, while g would require twelve.

Table of Results.—The results of four calculations will appear in the table. In the first all the coefficients—e, f, and g—are determined. The census figure for 1870 is rejected, but the law of natural increase is supposed to operate undisturbed from 1860 to 1870, as in the decades before and after. This gives the results headed A.

In the second calculation g is taken as zero, and, as before, no break is supposed between 1860 and 1870. This calculation is denoted B.

The third calculation, C, differs from B by supposing that the law of increase, which applies from 1820 to 1860 and after 1870, is not true for the decade of the civil war, and that a new start must be made from the latter date, the difference between the new value and that calculated from the 1860 figure denoting the effect of the extraordinary losses by wounds, disease, etc., during that decade.

The fourth calculation, D, agrees with C in recognizing a break after 1860, but it takes $f = 0$, and so determines e and g. Two lines are given in the table for the date 1870, where the calculation assumes a break, the first showing a normal increase from

1860, and the second making allowance for extraordinary losses (marked *l* in the table). All differences, ratios, etc., in which the census population for 1870 enters are put in parentheses.

In forming the four columns of calculated population the formula is applied to the figure found for the beginning of the decade to obtain the natural increase. To this is added the ascertained immigration for the decade. The result is the total increase, and hence is derived the calculated figure for the end of the decade.

The second column of the table shows the census population in millions and decimals of a million for the dates in the first. The third column gives successive differences of the second. The fourth shows the immigration, and the fifth the difference between the two preceding, here called "natural increase." The percentage formed by that increase, compared with the population at the beginning, next appears. This shows a general falling off in value, as noted above, while its reciprocal, denoted $\frac{p}{\Delta p}$ in the seventh column, is the number represented by $e + fp + gp^2$ in our formula. The remaining columns give the four calculations of population, as already explained. Each calculated value is followed by the correction reducing it to the value actually found.

Another word as to the meaning of the coefficient *e*, the number of people that increased by a unit (as 2.862 to 3.862, 2.279 to 3.279, and so on) in ten years, when the population was very scanty. The length of time in which the population would double itself under those circumstances, by natural increase, is found by ascertaining what power 2 is of $1 + \frac{1}{e}$. The four calculations give 23, 19, 21, and 26½ years respectively. The time of doubling lengthens without limit as the population increases, and the effect of coefficients other than *e* appears.

Comparison of Four Calculations.—All calculations agree in indicating a large deficiency for the census population in 1870, which was 898,000 by the last and nearly double as much by the first. The 1890 census was also short by a less amount, while that of 1880 gave an excess according to all four. The census figures from 1820 to 1860 are much more easily reconcilable. None of these is more than a hundred thousand in error by more than one of the four calculations, and only one census, that for 1830, errs in the same direction according to all

Population by Census and by Formula

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year.	Population.	Increase next 10 years.	Immigration.	Natural increase.	Per cent.	$\frac{p}{\Delta p}$	A		B		C		D	
							Calc.	Cor.	Calc.	Cor.	Calc.	Cor.	Calc.	Cor.
1820.....	9.634	3.232	.140	3.092	32.10	3.116	9.696	— .062	9.576	+ .058	9.659	— .025	9.802	— .168
1830.....	12.866	4.203	.563	3.640	28.29	3.535	12.786	+ .080	12.803	+ .063	12.803	+ .063	12.770	+ .096
1840	17.069	6.123	1.607	4.516	26.45	3.780	17.047	+ .022	17.154	— .085	17.085	— .016	16.935	+ .134
1850.....	23.192	8.251	2.652	5.599	24.14	4.142	23.233	— .041	23.331	— .139	23.240	— .048	23.126	+ .066
1860.....	31.443	(7.115)	2.374	(4.741)	(15.08)	(6.632)	31.461	— .018	31.427	+ .016	31.417	+ .026	31.571	— .128
1870.....	(38.558)	(11.598)	2.812	(8.786)	(22.79)	(4.389)	40.303	(—1.745)	40.110	(—1.552)	{ 40.331 { 39.571	(l .760) (—1.013)	40.890 39.456	(l 1.434) (— .898)
1880.....	50.156	12.466	5.247	7.219	14.40	6.948	50.124	+ .032	49.924	+ .232	49.714	+ .442	49.829	+ .327
1890.....	62.622	.....	3.750	.....	.....	.....	62.635	— .013	62.767	— .145	63.064	— .442	62.949	— .327
1900.....	.....	.....	.....	.....	.....	.....	73.648	.....	74 693	.....	75.679	.....	74.466	.....

In calculation A, $e = 2.862$, $f = .035$, $g = .00091$
" B, 2.279 .086 .0
" C, 2.57 .073 .0
" D, 3.35 .0 .0012

four. Perhaps this may be taken as an indication that the 1830 census gave a somewhat excessive total, while the others were fairly close to the truth. Calculation C gives a near agreement with all these ante-bellum results, while B and D show systematic divergences. To those since the war, on the contrary, B and D are both nearer than C. The agreement of A for every census but 1870 is strikingly close.

No attempt has been made to compare these results by aggregating the residual corrections and so computing a probable error of quantities found, because this work could only be misleading. It is plain that the results of calculation A would come out best and C worst by such test, residuals in parentheses being omitted; and yet it is the belief of the writer that the result under C for 1900 is nearer the truth than that under A. He does not believe that the rate of natural increase has really reached a maximum and is now diminishing, as both A and D require (for $\sqrt{\frac{e}{g}} = 56$ by A and 53 by D). He does not believe that the discordance of the 1870 census is altogether due to omissions in taking it, or that it can really be a million and three-quarters short. A calculation in the preface to the population volumes for 1890 made the deficiency a little over a million and a quarter, and even that figure is probably too high, because it depends upon a supposition that the southern section of the country, which had suffered most in the war, yet increased during that decade correspondingly with other sections. The writer believes that three-quarters of a million is a fair estimate for war losses in the 1870 census, and that the official figures were little, if any, over a million too small—about as calculation C makes them. It is more probable that the eleventh census, or both the tenth and eleventh, were largely in error, than that such a theory of the ninth census as is shown under calculation A is true.

Final Result for 1900.—The final figures under the four calculations have a range of two million and indicate a corresponding uncertainty in the prediction. The highest of them is two million less than the Treasury Department's calculation would give: the estimates of population which accompany the monthly financial reports point to a value of 77,676,000 for June, 1900. Those estimates show substantially uniform third differences, and therefore appear to connect population with time by an algebraic equation of the third degree. There is no evidence of an attempt to take separate account of immigration in the

Treasury estimates. A conclusion inconsistent with them requires therefore little apology.

Reasons have been given for preferring calculation C, which gives the largest result of the four, to the others. The writer can only present his own views for what they are worth. According to them the population to be shown by the twelfth census will be more probably above than below 75,000,000, but is altogether unlikely to reach 76,000,000. If it should be anything like so high, it will indicate a deficiency in the last census total sufficiently marked to invalidate any computation for the future in which the figures of that census are adopted, without correction or criticism. In fact, while it is necessary to take the whole series of results, so far as that can be done, as a foundation for any law which is applied to further calculations, it is necessary also to correct one set of figures by others, that the result may be as little as possible tainted by errors belonging to one or a few previous results. If it be supposed, on the other hand, that all discrepancies between census figures and calculation are indications of real irregularities of which the calculation takes no account, it need hardly be added that such a supposition negatives the validity of any possible prediction from the data at command.

THE DEFINITE LOCATION OF BOUVET ISLAND

The last number of the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* is entirely devoted to the recent German deep-sea expedition of the *Valdivia*. The navigating officer of the ship gives an interesting account of the rediscovery of Bouvet island. It appears that in the year 1738 a French company in search of the Terra-Australis, supposed to be a fruitful and populous country, sent out two ships, one of them, *L'Aigle*, being commanded by Captain Lozier Bouvet. On January 1, 1739, Bouvet discovered land which he supposed to be a mere promontory, and which he called Cape Circumcision. During nine days, however, Bouvet found it impossible to effect a landing and was forced to continue his journey. In 1775 Cook searched for Bouvet's discovery, but, finding nothing, concluded that Bouvet had been deceived by large masses of ice. In October, 1808, Captain Lindsay, commanding the whaler *Swan*, belonging to Messrs Enderby, and who had been commissioned by them to search for Bouvet land, sighted an island, which he called Lindsay island, in the locality in which he was directing his search for Bouvet land. Lindsay found it impossible to land, and gave a brief description of the estimated dimensions and general contour of the island. In 1825 Captain Norris, of the whaler *Sprightly*, sighted an island and assigned a certain position

to it, calling it Liverpool island. In 1843 Sir John Ross, commanding the *Erebus*, searched for Bouvet land and came to the same conclusion that Cook did because he failed to find it.

Thus our knowledge of the facts remained until the *Valdivia*, after a careful search, sighted the island on November 25, 1898. The position of the island, which is given as latitude S. 54° 26.4′, longitude E. 3° 24.2′, does not correspond with that assigned by Bouvet to his discovery, or to the positions given by Lindsay or Norris, but a thorough and careful discussion of the subject warrants the belief that Liverpool, Lindsay, and Bouvet islands are identical, and therefore the discoverers adhered to the latter name. The island is about four nautical miles in diameter and rises to a height of 935 meters. The shores are abrupt and inaccessible and glaciers come down to the water's edge, while the summits of the mountains are covered with ice and snow. A few birds, notably *Daption capensis* and *Pagadroma nivea*, were seen on the island, but otherwise there were no signs of life.

O. H. Tittmann.

U. S. Coast and Geodetic Survey.

PEARY'S WORK AND PROSPECTS

Peary's latest year in the Arctic, after all allowance has been made, stands as a record of magnificent achievement, and a foundation upon which still greater results are to be attained. The entire country north and west of Cape Sabine, reaching beyond Greely fiord and the eightieth parallel, has been definitely outlined and the confused and utterly inaccurate coastline, sinuous and perplexing to the last degree, of the western side of Smith sound, between Capes Sabine and D'Urville, has been definitely measured and charted. The striking change in the character of the western slope of Grinnell Land is in itself enough to justify and reward the expedition, and will stimulate workers in that most inviting and heretofore neglected field. The hand-to-hand battle against the opposing forces of darkness, frost, and distance which Peary waged during the entire winter makes a chapter daring and effective as any recorded in Arctic history. Where other explorers have waited in more or less impatience, sometimes in comfort and many times in suffering, Peary has been continuously in the field, daunted by no obstacle, and breaking the route along an almost impassable ice-foot for 250 miles. This, too, was not as a mere exploit, but as a practical step in the greater work to be determined next spring. Peary rounded up his year's work with a further personal reconnaissance to the westward, and practically completes twelve months of active work in the open field.

The American people, learning as they will shortly from Peary's own pen the story of the year, cannot fail to feel a sense of pride in their countryman and an excitement of hope that ultimate success may crown his effort to attain the goal of the ages and place his country's flag at the very farthest north. Those who read between the lines and who follow

matters practically, find in Peary the mental as well as physical traits, making a combination as rare as the work he has undertaken, coupled with a clear head, and a practical, definite correlation of means to ends, which go far to secure the results desired. Peary will take the field next year, barring unforeseen accidents, a thoroughly sound, rested, and well man, in the very prime of condition, and can be counted on to make a record, even if he does not fully attain his desire. If beaten in 1900, he will try it again in 1901, and maybe again a year later. The very latest word is the very gratifying one that the old *Windward*, battered and scarred from her winter in the ice and stormy passage home, is still sound and seaworthy; that the ship will be repaired, rebuilt, and refitted, and, under an American flag and American master, will return to her contest with the forces of the north, from which she will not come back unless victorious.

H. L. BRIDGMAN.

Brooklyn, N. Y.

PEARY'S EXPLORATIONS IN 1898–1899

"The Mission of the Diana," outlined in THE NATIONAL GEOGRAPHIC MAGAZINE for July (see p. 273), has been successfully carried out in every detail under the able management of Mr H. L. Bridgman, Secretary of the Peary Arctic Club. More than a year's supplies have been added to the reserve stores of Peary and full accounts obtained of his important explorations during the past twelve months. Thus far merely an outline of his discoveries has been published, but, as Mr Bridgman has stated in the preceding article, a more detailed account will soon follow.

Instead of reaching Sherard Osborn fiord, on the north coast of Greenland, beyond the narrow channel which all sailing craft must take to reach that part of the globe, Peary was obliged to winter in Kane basin, about 50 miles north of Cape Sabine. His ship stayed in latitude 79°, and not 82°, as he had hoped might be possible. Not having been able to establish his base of sledging operations near Sherard Osborn fiord, he nevertheless ventured northward during the winter four times to Fort Conger, the headquarters of the Greely expedition, a point equally near the Pole, but on the west side of the channel. These long trips were made both for exploration and also to establish caches of supplies along the west side of the channel leading to the north, so that they may be available next spring and during the time the party is engaged in its explorations next summer. These supplies and others that will be added to them will enable Peary to begin his researches on the north coast of Greenland whether or not the *Windward* is able to land her stores at the proposed base in Sherard Osborn fiord.

In the south Peary discovered that the so-called Hayes sound, northwest of Cape Sabine, is only an inlet or bay. It was supposed by many that it extended through to the Arctic ocean west of Ellesmere Land and separated that country from Grinnell Land on the north. Peary's discovery proves that these regions are one and the same land, and he has

thus been able to settle one of the most important geographical problems that awaited solution in that region. He also traveled west across the northern part of Ellesmere Land, which has never before been penetrated for any distance, and visited its west coast, joining his survey of the shoreline with the short bit of the coast further north, which Lockwood, of the Greely expedition, discovered in May, 1883. This is the first time that any part of this coast has been seen south of the inlet visited by Lockwood. In his various sledge journeys up the channel from the *Windward's* position, Peary skirted the east coasts of Grinnell Land and Grant Land for a distance of about 250 miles, rectifying the mapping of this shoreline in some respects, and particularly the surveys of a number of indentations. Fort Conger was the headquarters of the Greely expedition, and Peary was the first to visit the place since Greely left it, in 1883. The most northern point reached by Peary was Cape Beechey, about 82° north latitude. No effort to push northward has been made this summer, and Peary's winter camp has been established on the Greenland side of Smith sound, several miles further south than his quarters of a year ago. Here he has landed all the remaining provisions of the *Windward* and all that the *Diana* brought him.

The *Diana* reports landing the Stein party at Cape Sabine and leaving them in good spirits for a winter in Ellesmere Land. The hunting party led by Russell W. Porter, of Boston, left the ship at various points on the Greenland coast and secured a number of walrus, reindeer, and other game, most of which was added to Peary's stores. Sverdrup in the *Fram* was frozen in near Cocked Hat island, ten miles west of Cape Sabine, where he wintered about 50 miles south of the point reached by Peary. Sverdrup planned this summer to work his ship up Kennedy channel, leaving the *Fram* at some point along the coast for a sledge trip across or around the northern end of Greenland.

THE CALIFORNIA AND NEVADA BOUNDARY

The oblique boundary between California and Nevada, which lies between the intersections of the 39th parallel of latitude with the 120th meridian and the 35th parallel of latitude with the Colorado river, a distance of about 400 miles, was retraced and temporarily marked by the U. S. Coast and Geodetic Survey between the years 1893 and 1899, the work being advanced from time to time as money was available for that purpose.

The line passes over very rough country, varying in altitude from 750 feet at the Colorado river to 13,000 feet at the White mountains. The lofty elevations made it possible to obtain some very long sights, the maximum being 68.8 miles, between the Sweetwater mountains (10,500 feet) and the White mountains. There were two other sights over 60 miles in length. The line was ranged out with a theodolite, beginning at Lake Tahoe and running to the southeast. In order to put points in the line at long distances, heliotropes, with a suitable code of signals, were used. The termini, both at Lake Tahoe and on the Colorado river, were estab-

lished by telegraphic longitude, and latitude determined by observations with the zenith telescope. A scheme of triangulation was carried along the entire line, so that each distance was checked. Four base lines were in the scheme, three of them measured with steel tape and the other derived from the Yolo, a primary base nearly 11 miles in length.

An azimuth was measured at Lake Tahoe to get the direction of the line, and no change was made in the entire distance. After ranging out the random line, it was corrected back to the starting point.

The random line passed southwest of the Colorado terminal post, 400 miles from the beginning..... ..... 150.5 meters.

A line 3,180.3 meters long on the Colorado river, depending on the Needles base (steel tape), was found to differ when determined by triangulation brought through from Lake Tahoe..... ..... 0.2 meters.

Difference of azimuth of the same line, brought through from Lake Tahoe..... ..... 10.2″

It may be stated that the uncertainty in azimuth, or direction of the line, amounted to one minute of arc. The local deflection in latitude at the Lake Tahoe end is nearly 300 meters, and almost as much at the Colorado terminus.

C. H. SINCLAIR.

U. S. Coast and Geodetic Survey.

GEOGRAPHIC LITERATURE

A Primer of Forestry. Part I.—The Forest. Bulletin No. 24, Division of Forestry, U. S. Department of Agriculture. By Gifford Pinchot. Pp. 88, pls. 47, with 83 cuts in text.

This beautiful booklet, tasteful in typography, artistic in illustration, neat in binding, and attractive in *ensemble*, marks an innovation both in the Department of Agriculture and in the Government Printing Office; and it is far removed from the conventional government publication in content as in dress. The four chapters summarize the science and epitomize "the art and mystery" of modern forestry in simple, comprehensive, yet withal vivid language, adapted alike to busy layman and anxious learner; the style is that of the highest magazine order—*i. e.*, that of the vanguard of literary progress. So the book affords attractive, not to say alluring, reading. A sub-title, "Part I—The Forest," gives gratifying promise that the innovation will be pursued and the style maintained. In the first chapter "The Life of the Tree" is outlined and illustrated by sun pictures in effective fashion, and in such terms as to picture clearly the structure and functions, or the anatomy and physiology, of the arborean organism; the second chapter treats of trees in their collective aspect, both as forests and as successive generations of arborean species; the third chapter deals with "The Life of the Forest" in such manner as to bring out the relations between the arborean collectives and their environment, both physical and vital; while the final chapter is devoted to the "Enemies of the Forest" (which are chiefly

traceable to the human factor in the arborean environment), and to the means of counteracting these enemies. So the treatment is notably broad and comprehensive; yet the grasp displayed in each chapter, and indeed each paragraph, is strong and close. The book may be commended, no less to teachers and pupils than to general readers, as an example of scientific method applied to an important practical subject; it may be commended to makers of scientific books as a model, and to laymen as a worthy bit of literature of the objective sort. The author and the Agricultural Department are alike to be congratulated on its appearance.

W J M.

The Break-up of China. By Lord Charles Beresford. 8vo, pp. xxii + 491, with portraits and maps. New York and London: Harper and Brothers. 1899. $3.00.

Sir Stafford Northcote was sagacious when, in behalf of the Associated Chambers of Commerce of Great Britain, he selected Lord Charles Beresford as the man to visit China and report upon British interests in that empire. Rarely, if ever, has one uniting so high rank, recognized ability, and wide experience been sent as an envoy of commerce on a tour of inspection. All doors would open before him. He would observe carefully, make no blunders, and afterward narrate just what he had seen.

Reaching Hongkong September 30, 1898, he did not leave China until January 9, 1899. During that time the Chinese government did all in its power to further his mission. Though invested with no diplomatic functions, he found everywhere the highest authorities—Tsung-li Yamen, viceroys, mandarins, governors, admirals—accessible and sympathetic. He "inspected the whole military force of China, and by permission of the generals put the troops through the various movements, in order to test their efficiency." He "visited every fort, every arsenal, with one exception, and all the naval and military schools; also the ships of both the Chinese fleets, viz., the Peyang and Nanyang squadrons, and one dockyard." He "visited those places where British communities reside and wherever there was a chamber of commerce convened meetings" and "obtained the opinions of the members;" nor did he lose an opportunity "of seeking interviews with representatives of all foreign nations holding trading interests in China." On leaving that country he returned home through Japan and the United States, "hoping to be able to obtain from the chambers of commerce some definite opinions for the Associated Chambers of Great Britain."

The results of his faithful observation and investigation are set forth in this somewhat ponderous book. Lord Beresford terms it "a plain statement of valuable facts for immediate use." A large part of this information is accessible nowhere else. Because of the known reputation of the author, its statements, as far as they are statements of facts and not personal inferences and opinions, are entitled to full credit.

The title, "The Break-up of China," expresses what the author realizes is becoming a fact. This catastrophe he deplores, believing it injurious to Great Britain. A patriotic British subject, his outspoken and only concern is the advancement of British interests. There is no hypocrisy or

cant about him. Knowing that his country retains the commercial scepter of the world with a failing hand, he would keep China alive so as not to lose a purchaser. His position does not differ from that of any other commercial traveler, except that the commercial house he represents is the British empire, and that the wares which he would press into the market are whatever that empire produces. For the fall of China, now perhaps inevitable, but which once might have been avoided, he holds the inefficient foreign policy of the British government responsible. Meanwhile he forgets or ignores the fact that to China's territorial integrity, to the physical welfare of its people, and to the authority of its government more staggering blows have been dealt by Great Britain than by any other country. An ardent advocate of an Anglo-American alliance, he insists that "the interests of the United States and Great Britain are absolutely identical." He does not fear Russia, but he reveals an awesome consciousness of Russia's existence. He suggests in his first interview with Chinese authorities "that the British government would allow an officer to help the Chinese to put their army in order." When shortly afterward asked "whether, if China put the whole of her armies under British officers, Great Britain would assist China in any quarrel that might arise between her and any other power," he remarked that he "would not enter into any political questions, but that the last thing Great Britain wanted to do was to mix herself up in quarrels which might arise between other countries." It is not strange that "the idea is gaining ground all over China that Great Britain is afraid of Russia."

The disintegration of an empire containing 400,000,000 people, and yet powerless to protect itself, is an astounding spectacle, unparalleled in history. Yet such impotence is an argument against its political continuance. It is difficult to doubt that the break-up of China will advance civilization and even benefit the fragments into which the empire breaks.

EDWIN A. GROSVENOR.

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Les Lacs Français. By André Delebecque, etc. With portfolio atlas containing plates i–xi. 4°, pp. xii + 436, pls. xxii. Paris: Typographie Chamerot et Renouard. 1898.

This is an imposing and exceedingly rich repository of information concerning the lakes of France in their principal aspects. Beginning with a lively preface, in which he emphasizes the declaration that there *are* lakes in France, the author proceeds in the first chapter to classify the water bodies by the natural provinces in which they occur, including the Alps, the Jura, the Vosges, the Central plateau, the Pyrenees, and the Atlantic and Mediterranean littorals. The second chapter recounts the processes of sounding with the apparatus employed, and sets forth the results which are shown in greater detail in the accompanying atlas, while the third chapter is a detailed description of the more noteworthy lakes. Then follows a chapter on the lacustrine topography, including shores, bottoms, islands, taluses, fans and deltas, submerged ravines, etc., and another on the lacustral sediments and other constituents of the lake basins. The next chapter is devoted to supply, discharge, evaporation, and changes in level of the lakes, and still another to temperature,

which is discussed in some detail with relation to climate, depth, temperature of affluents, etc. In chapter VIII the colors are described and the principal causes of coloration analyzed, while the mirage receives attention; and the succeeding chapter is devoted to extended consideration of the solid and gaseous materials held in solution in the lacustral waters. The portion of the work of widest interest is the tenth chapter (pages 242–343), in which the geologic relations of the region and the lakes are discussed at length, and which ends with a classification of the water bodies by known or supposed origin. The historical and social aspects of the lakes are indicated in the eleventh chapter, which is followed by an extended descriptive table of the principal lakes of France, with reference to the provinces in which they occur, and to the sheets of the official maps on which they are represented. The work is fully indexed and well supplied with lists of contents and illustrations. There is little reference to the accompanying portfolio, which is really a distinct publication; its sheets are variable in size and form and show little more than the shores and subaqueous contours of the principal lakes; and their convenience is somewhat diminished by inconstancy in contour-intervals and bathymetric tints. The monograph forms a highly useful compendium of facts arranged in accordance with well-established scientific principles.

W J M.

RAILROADS AND CANALS

The important bearing which the great reduction in rates for railway transportation has on the question of canal construction and maintenance is attracting widespread attention. In a recent letter to the committee on canals of the state of New York, the Hon. Abram S. Hewitt, until now one of the staunchest friends and advocates of the state canals, and one who has done more to promote the cause of the New York state waterways than any other living man, writes as follows:

> I was brought up in a school of politics which taught that the prosperity of the state of New York was created by the canals and could not be maintained unless they were kept in a state of perfect efficiency.
>
> But a new condition has appeared in the great reduction of the cost of transportation by the railways which compete with the canals for business. This reduction is due to several causes: notably, the greater durability and the lower cost of steel rails, the increase in the train-load, and the economy of fuel in hauling a train. . . . My knowledge of the subject inclines me to believe that we have reached a permanent era of low cost of transportation by rail. . . . Hence the question is presented in altogether a new light, and although I am reluctant to come to the conclusion that the canals have lost their usefulness, I confess freely that the argument for their continued maintenance is greatly weakened if not altogether destroyed.

GEOGRAPHIC MISCELLANEA

THE British Association for the Advancement of Science has granted $5,000 toward the expenses of the English Antarctic expedition of 1901.

THERE passed through the American and Canadian ship canals at Sault Ste Marie during July 4,024,789 tons of freight, or 778,000 tons more than in the corresponding month last year.

THE medical expedition sent to the Philippines in early spring by the Johns Hopkins University for the purpose of studying the characteristics of tropical diseases in those islands left Manila some weeks since and will probably reach Baltimore early in October.

"GUARDING the Highways of the Sea," contributed by Theodore Waters to *McClure's Magazine* for September, is very readable and from a popular point of view is an excellent description of the work and records of the Hydrographic Office of the Navy Department.

THE *Railroad Gazette* estimates the railroad building in the United States during the six months ending June 30 as aggregating 1,181 miles. The longest line completed by any one company was 64 miles, and the five leading lines aggregated only 244 miles, or an average of less than 50 miles each.

THE magnetic survey of Maryland has now been practically completed, the distribution of the stations being such that on the average there is one station for every 100 square miles. The expenses of the work, with the exception of this year, have been entirely borne by the Maryland Geological Survey.

THE excursion of geologists last summer to the fossil fields of Wyoming, under the patronage of the Union Pacific Company, will add some rare specimens to the collections of different universities throughout the country. It is believed that several fossils of a new species have been obtained. Though the excursion was originally planned for 30 days, many of the geologists are still at work in the field.

A TELEGRAM from Tacoma, Washington, announces the return of A. J. Stone, corresponding member of the Zoölogical and Ethnological Museum of Natural History and New York Zoölogical Society, who for the past two years has been traveling about the Arctic circle studying the geographical distribution of animals in that section. It is reported that during five months of travel last winter he covered 3,000 miles of Arctic coast and mountain entirely above the Arctic circle.

REPORTS from Alaska *via* Seattle, Washington, describe two distinct earthquakes felt from Lynn canal to the Aleutian archipelago. The first, on Sunday, September 3, did but little damage, but it was followed by a very severe shock on September 10. Several islands are said to have settled from 20 to 25 feet. A report received by the U. S. Coast and Geodetic Survey shows that an earthquake was also felt in Prince William sound on September 3, but that no damage was done at this point.

CHARLES PATRICK DALY, LL. D., for 35 years president of the American Geographical Society of New York City and former chief justice of the court of common pleas of New York, died at his home, in Sag Harbor, Long Island, September 19, 1899. While preëminently a lawyer and a jurist, his long connection with the society of which he was the president and his honorary membership in the National Geographic Society, the Royal Geographical Society of London, the Berlin Geographical Society, and the Imperial Geographical Society of Russia will make his death especially felt in geographic circles.

The Geographical Journal for September opens with the first of a series of articles by Dr Francisco P. Moreno on his "Explorations in Patagonia" at different times between 1873 and 1897. Capt. G. E. Smith, R. E., contributes a description of "Road-making and Surveying in British East Africa." Robert T. Turley describes a "Tour in 'No Man's Land,' Manchuria." Other articles of interest are "The Cambridge Anthropological Expedition to Torres Straits and Sarawak," "From Njemps to Marich, Save, and Mumia's (British East Africa)," by Major H. H. Austin, R. E., and "Dr Passarge's Journeys in South Africa."

AN interesting feature of the "Pilot Chart of the North Atlantic Ocean" for September is a diagram prepared from investigations made by Prof. George Davidson, of the University of California, showing the line separating the lands of the Pacific where American date is kept from those where Asiatic date is kept. The line passes through Bering straits, skirts the Aleutian islands on the west extremity, and then follows the 180th meridian southward as far as the Fiji islands, where it diverges slightly to the east. Thus the Aleutian, Hawaiian, and Samoan islands keep American time, while the Marshall and Fiji islands and New Zealand follow Asiatic time, or are one day ahead.

A RECENT number of *Science* states that the American Museum of Natural History at New York City has now 23 representatives in the field, engaged as follows: "The Jesup expedition to the North Pacific, making archæological and ethnological researches in British Columbia and northeastern Siberia; the Jesup zoological expedition to the United States of Colombia; the Constable expedition to the Northwest for large mammals; an expedition to New Mexico to study the cliff dwellings and the Pueblos; an expedition for the study of North American Indians in California and Arizona; a paleontological expedition to Wyoming; an expedition to Peru and Bolivia under Dr Bandelier, and local archæological work."

AN anchor and a buoy marked "Andrée Polar Expedition" are reported to have been found by a Norwegian cutter on the north coast of King Charles islands, east of Spitzbergen. Neither the Wellman nor the Peary parties in their explorations of the past year discovered any trace of the missing aeronaut; also the steamer *Antarctic*, which left Helsingborg, Sweden, May 25, with an expedition under Prof. A. G. Northorst to look for Andrée along the northeast coast of Greenland, on her return in September reported a fruitless search. The report received at the beginning of this year that the bodies of Andrée and his two companions had been found on the coast of Siberia has not been confirmed by later advices.

On August 26 General Lord Kitchener formally opened for traffic the bridge, built by American engineers, across the Atbara near its confluence with the Nile. Trains can now be run to within 75 miles of Khartum, and before the end of the present year the whistle of the locomotive will be heard at the capital of the Sudan itself. Mr Cecil J. Rhodes has the utmost confidence in the completion of the proposed railway from the Cape to Cairo within ten years, and, in view of the energy displayed in the construction of the 700 miles that have been built since the project began to be seriously considered, there is little doubt that the completion of a line of railway across the Dark Continent will be one of the early achievements of the coming century.

Various sites within a radius of 25 miles of Washington are being examined by parties under Dr Bauer's direction for the determination of the best location for the Coast and Geodetic Survey Observatory. The examinations thus far made have disclosed some interesting regional disturbances, especially in the vicinity of Gaithersburg. In order to determine what influence such regional disturbances have upon the variations of the earth's magnetism, such as, for example, the diurnal variation or the secular variation, it is proposed to mount a sensitive Eschenhagen dedinetograph at Gaithersburg, with the aid of which the variations of the most sensitive of the magnetic elements—the declination—will be continuously and automatically recorded.

The election of Hon. John Gifford, of Princeton, N. J., to a Chair of Forestry in Cornell University, a department recently established at that institution, is in line with the growing realization throughout the United States of the necessity of the study and solution of the forest problems of the country. Mr Gifford was the founder and the first editor of *The Forester* (then the *New Jersey Forester*), the official organ of the American Forestry Association, which is doing so much to promote the protection and care of the American forests. Last year Cornell University acquired 30,000 acres of woodland in the Adirondacks for the exclusive use of her forestry department. Over a million small trees, it is stated, have been planted in different sections of this tract, and several seed beds have also been laid out.

The Division of Forestry of the U. S. Department of Agriculture has recently issued a handsome little bulletin (No. 26), entitled "Notes on the Forest Conditions of Porto Rico," by Robert T. Hill, of the U. S. Geological Survey. The bulletin embraces the results of observations made during a rapid reconnaissance through the military department of Puerto Rico by Mr Hill in January, 1899, and contains not only a clear statement of the forest resources of Puerto Rico, but also such succinct descriptions of the physical features of the island as are necessary to an understanding of its forest problems. In the study and description of the native woods Mr Hill was assisted by G. B. Sudworth, Dendrologist of the Division of Forestry. Fifteen of the woods are reproduced by a process by which the impressions are made directly from the woods themselves, a process designed by S. J. Kübel and here used, it is believed, for the first time. An excellent feature of the bulletin is an admirable relief map of the island compiled by Mr Hill.

In *The Scottish Geographical Magazine* for September Francis H. Skrine presents a strong article, "From London to Karachi (India) in a Week," urging the construction of a branch connecting the English railway system in India with the Russian system in Turkestan. At present the British line ends at Chaman, on the southern border of Afghanistan, only 430 miles distant from the terminus of an offshoot from the main Russian line through Afghanistan. Mr Skrine asserts that the connecting link, including the necessary rolling stock, can be constructed for $15,000,000, as the route presents no great engineering difficulties. In the same issue of the magazine Alexander Begg describes "Vancouver Island, B. C.;" R. Blake White publishes some "Brief Notes on the Glacial Phenomena of Columbia (S. A.)," and A. D. Milne contributes a few "Notes from the Equatorial Province."

Major Ronald Ross, the leader of the expedition sent to Sierra Leone by the Liverpool School of Tropical Diseases to investigate the possibility of exterminating the malaria-bearing mosquito, has sent to Liverpool the following cablegram: "Malarial mosquito found. Ask government to send at once men." *Nature* states: "Major Ross' observations in India indicated that the malaria parasite is borne by the spotted-winged mosquitoes, and not by the common brindled or gray mosquitoes; and his message announces that he has found that malaria on the west coast of Africa is produced under the same conditions as in India. There is evidence that the malaria-bearing species only breeds in small isolated collections of water which can be easily dissipated, but the expedition has not yet had time to verify this point." In response to the request of Major Ross asking that workers should be sent out to join him at Sierra Leone, the school has dispatched, as an assistant to him, Dr R. Fielding Ould, of the Liverpool School of Pathology, who has had special experience in private bacteriological research.

A preliminary prospectus has been issued of the "Physical Atlas," in course of preparation by J. G. Bartholomew, F. R. S. E., F. R. G. S., under the patronage of the Royal Geographical Society. The Atlas, comprising seven volumes, consists of a series of maps illustrating the natural phenomena of the earth, being based to some extent upon the Berghaus Atlas, but comprehending much new and original material. Explanatory text accompanies the maps, and for each section of the work there is also a general introductory article, a critical bibliography, and an index. The work, which has been in progress for over ten years and is now approaching completion, is revised and edited by: Sir Archibald Geikie, geology; Sir John Murray, oceanography; James Geikie, orography; Alexander Buchan, meteorology, and a number of other distinguished scientists. The publishers, Messrs Archibald Constable & Co., of London, claim apparently with justice that the atlas is the most comprehensive publication of its kind ever attempted. The cost of production alone will, it is estimated, exceed $100,000. The meteorology section, with over 400 maps, will be issued during the autumn of 1899, the zoölogy, ethnography and demography, geology, botany, and other sections following in rapid succession. The price of each volume or section is $13.

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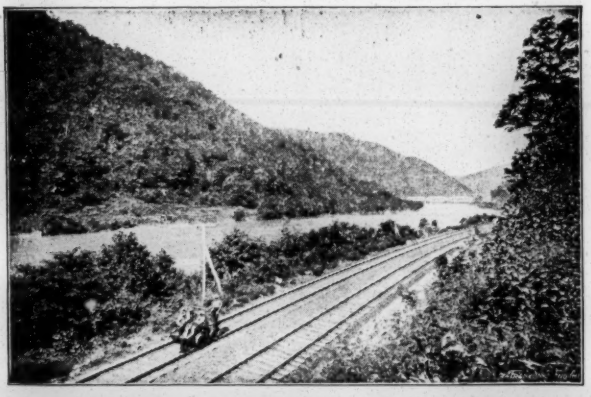

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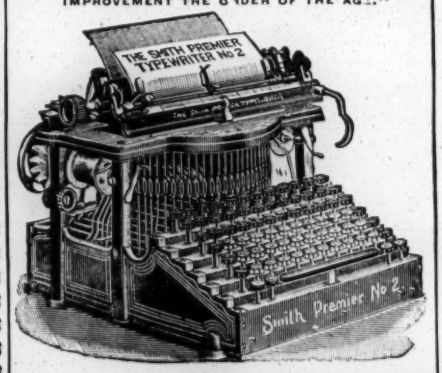

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